T0043-P Electro-hydrodynamic (EHD) Control of Two-phase Heat Transfer in Microgravity

Problem Statement

- Development of efficient thermal management systems utilizing two-phase heat transfer is critical for future NASA missions.
- Fight tests are required for the validation of the EHD ability to intensify and control two-phase heat transfer.
- Potential applications include high-heat dissipation systems in commercial and military spacecrafts and aircrafts.

Technology Development Team

- Principal Investigator: Boris Khusid, New Jersey Institute of Technology, khusid@adm.njit.edu
- Funding: NASA Headquarters, Office of Chief Technologist
- May partner in the technology development: Advanced Cooling Technologies, Lancaster, PA ; Sandia National Laboratories, Albuquerque, NM

Proposed Flight Experiment

Experiment Readiness:

- Summer 2014.

Test Vehicles:

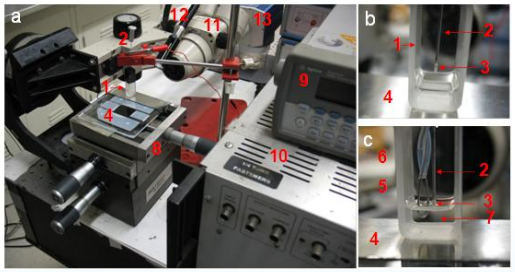
- Suborbital Reusable Launch Vehicles.

Test Environment:

- EHD experiment on suspensions was flown on parabolic aircraft in 2003. Flight tests for several minutes of microgravity are required to test EHD technology for two-phase heat transport

Test Apparatus Description:

- Lab setup for observations of the field driven flow: 1, quartz cuvette; 2, energized electrode with 3, tip; 4, grounded electrode; 5, heating element with 6, thermal insulation; 7, dielectric fluid; 8, 3-D micromanipulator; 9, function generator; 10, AC voltage amplifier; 11, microscope; 12, light source; 13, CCD camera.



Technology Maturation

- Successful flight tests will advance the EHD maturity from TRL 3 to TRL 6 or higher.
- Steps to mature technology: Fabrication and testing of EHD flow system: 4 months. Fabrication and testing of electrical, thermal, and optical subsystems: 8 months Lab tests and preparation for payload integration: 12 months Payload integration and flight tests: 12 months

Objective of Proposed Experiment

- Validate/correct predictions for EHD fluid flow in microgravity based on lab experiments on neutrally buoyant particles.
- Record and quantify field-driven fluid flow and bubble motion in flight tests for the development of EHD control of two-phase heat transfer in microgravity.

TA06 and TA14

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